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(58) Field of Search
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(54) Abstract Title
Liquid crystal display driver

(57) A liquid crystal display driver scheme that incorporates a bi-directional data transfer capability between a data packet generator (31) and RAM (33). Data is stored in RAM before being written to the display (35) and may be recalled for correction. The device is able to operate in a number of modes to either read, write or correct data packets before they are decoded by the display driver (34).

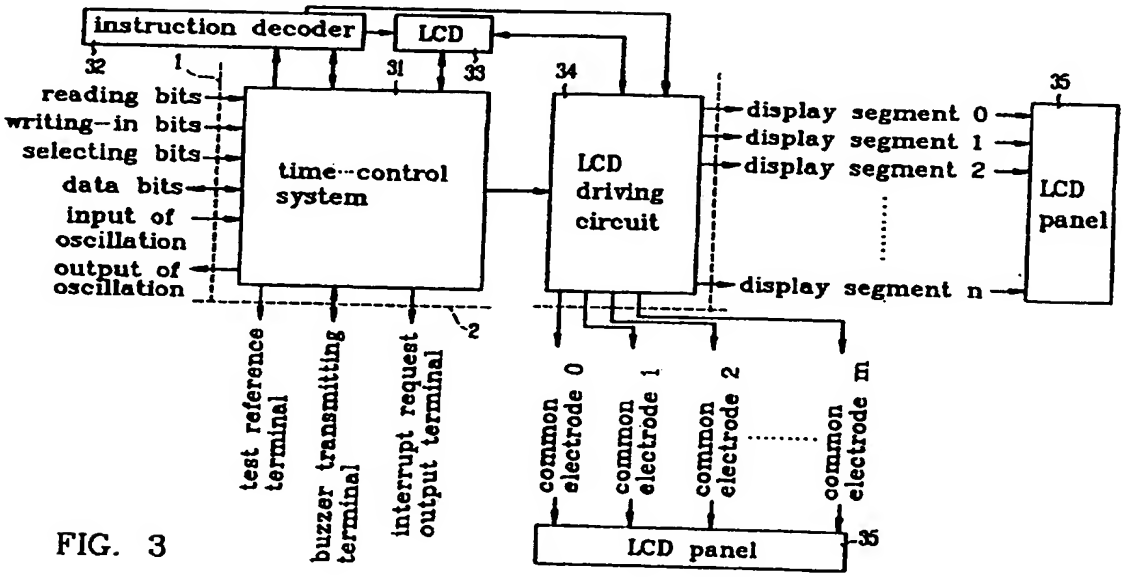

FIG. 3

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The print reflects an assignment of the application under the provisions of Section 30 of the Patents Act 1977.

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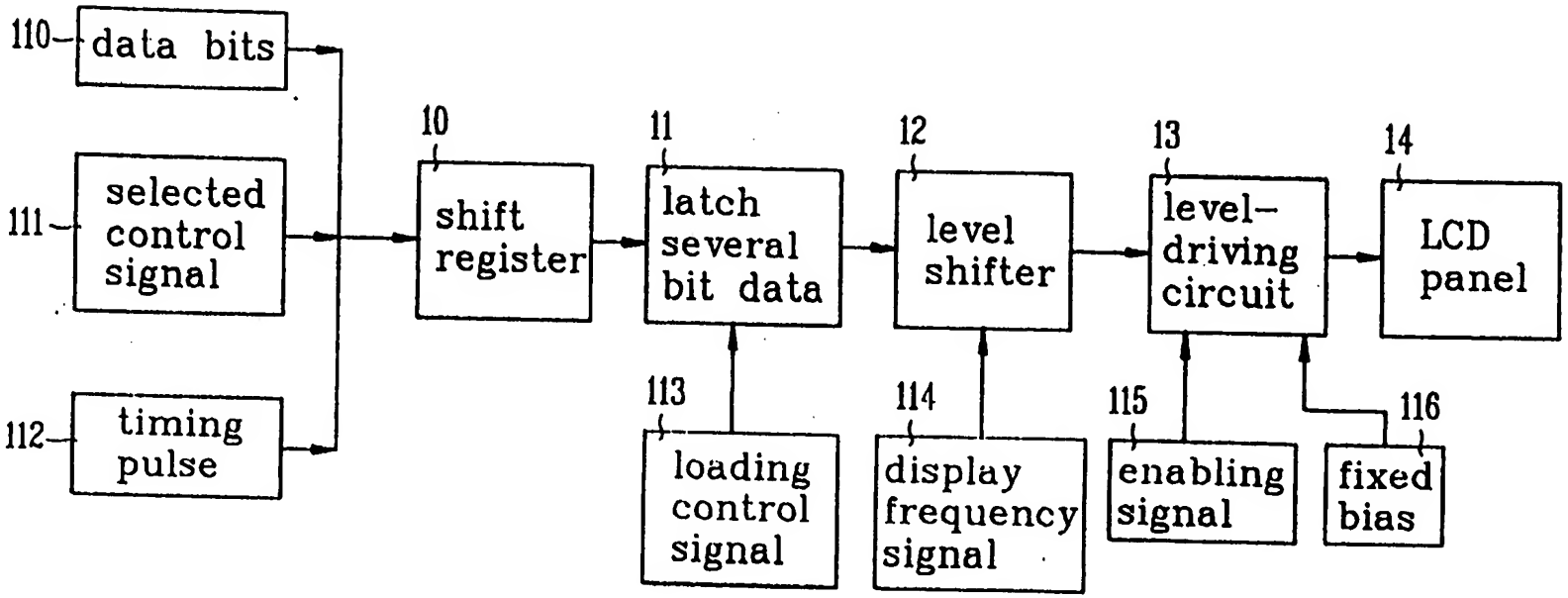

FIG. 1

BNS page 2

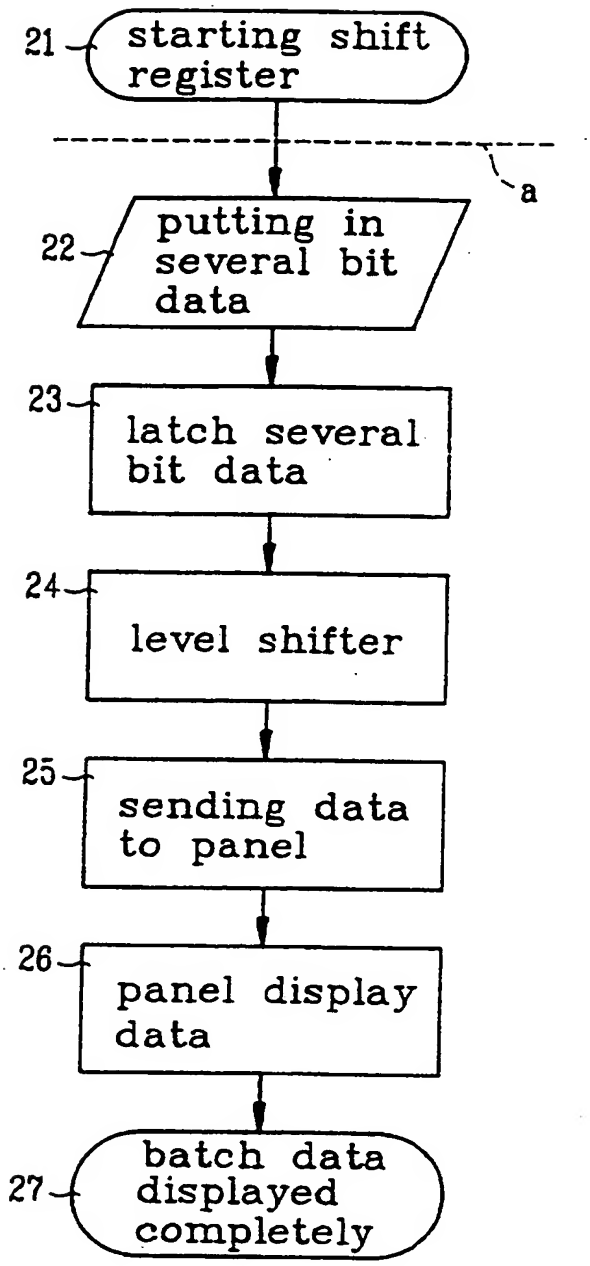
21
starting shift register
a
22
putting in several bit data
23
latch several bit data
24
level shifter
25
sending data to panel
26
panel display data
27
batch data displayed completely

FIG. 2

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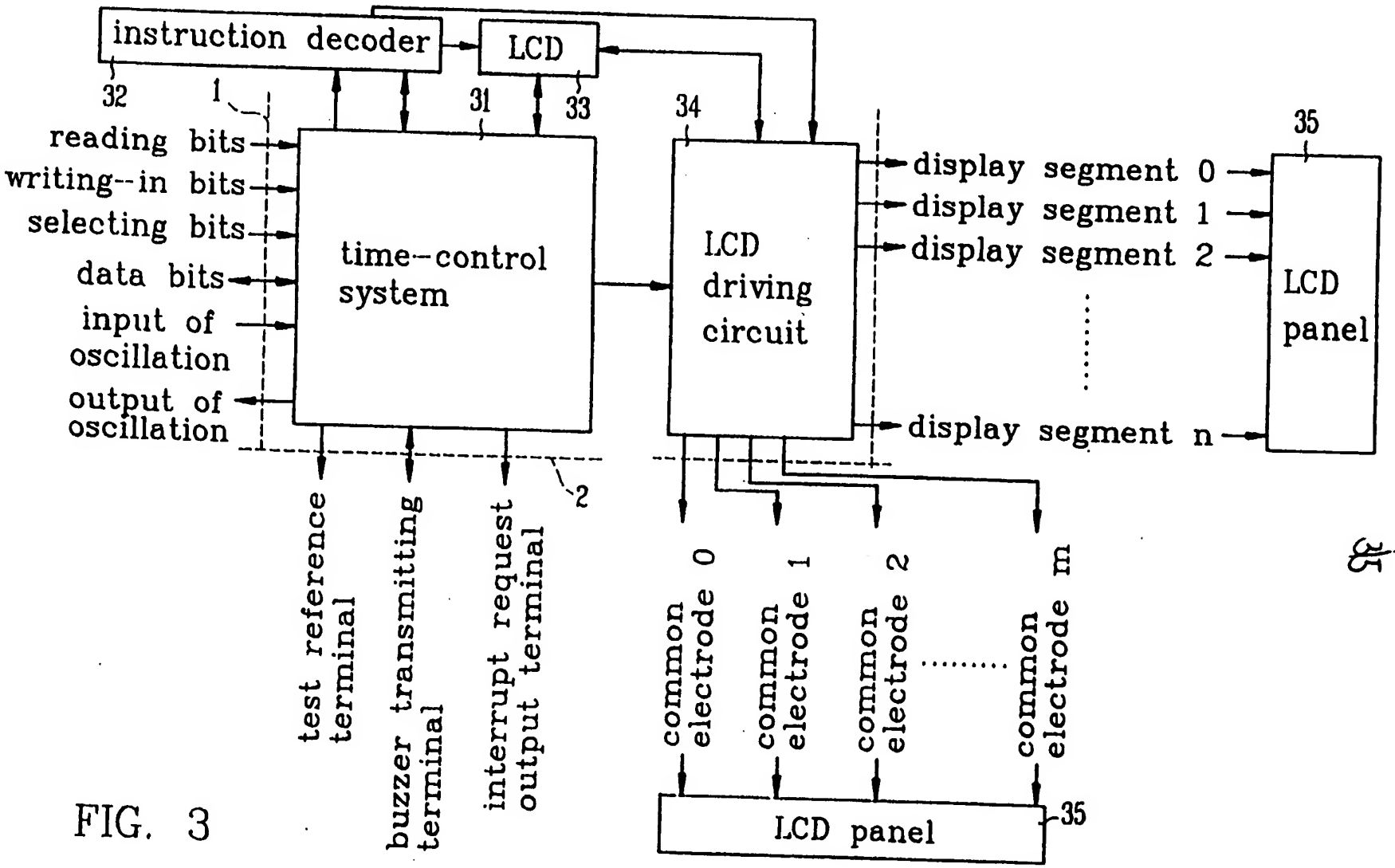

FIG. 3

BNS page 4

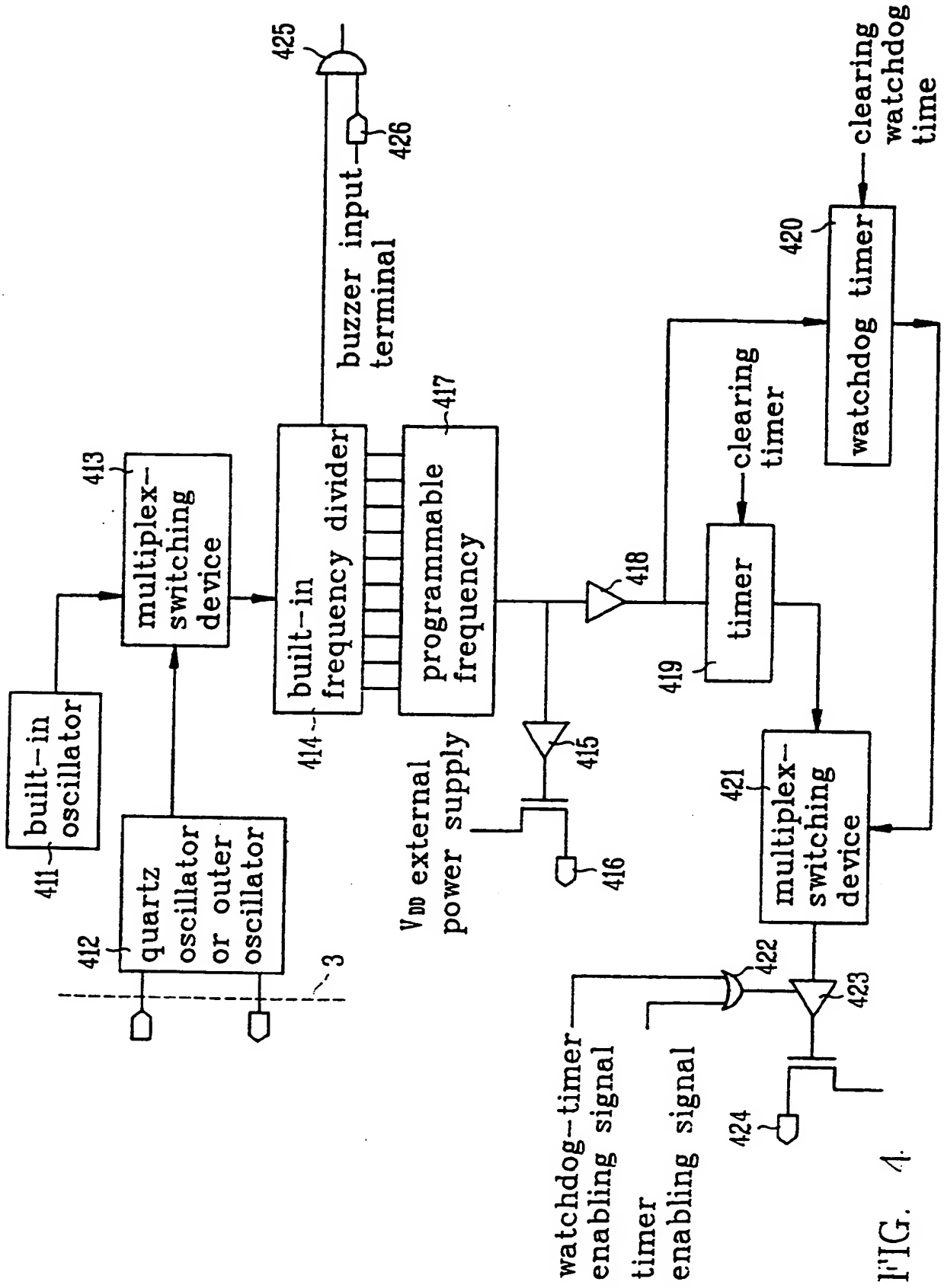
built-in oscillator
411
quartz oscillator or outer oscillator
412
3
multiplex-switching device
413
built-in frequency divider
414
programmable frequency
417
buzzer input terminal
425
426
V_{DD} external power supply
415
416
418
timer
419
clearing timer
watchdog timer
420
clearing watchdog time
multiplex-switching device
421
422
423
424
watchdog-timer enabling signal
timer enabling signal

FIG. 4

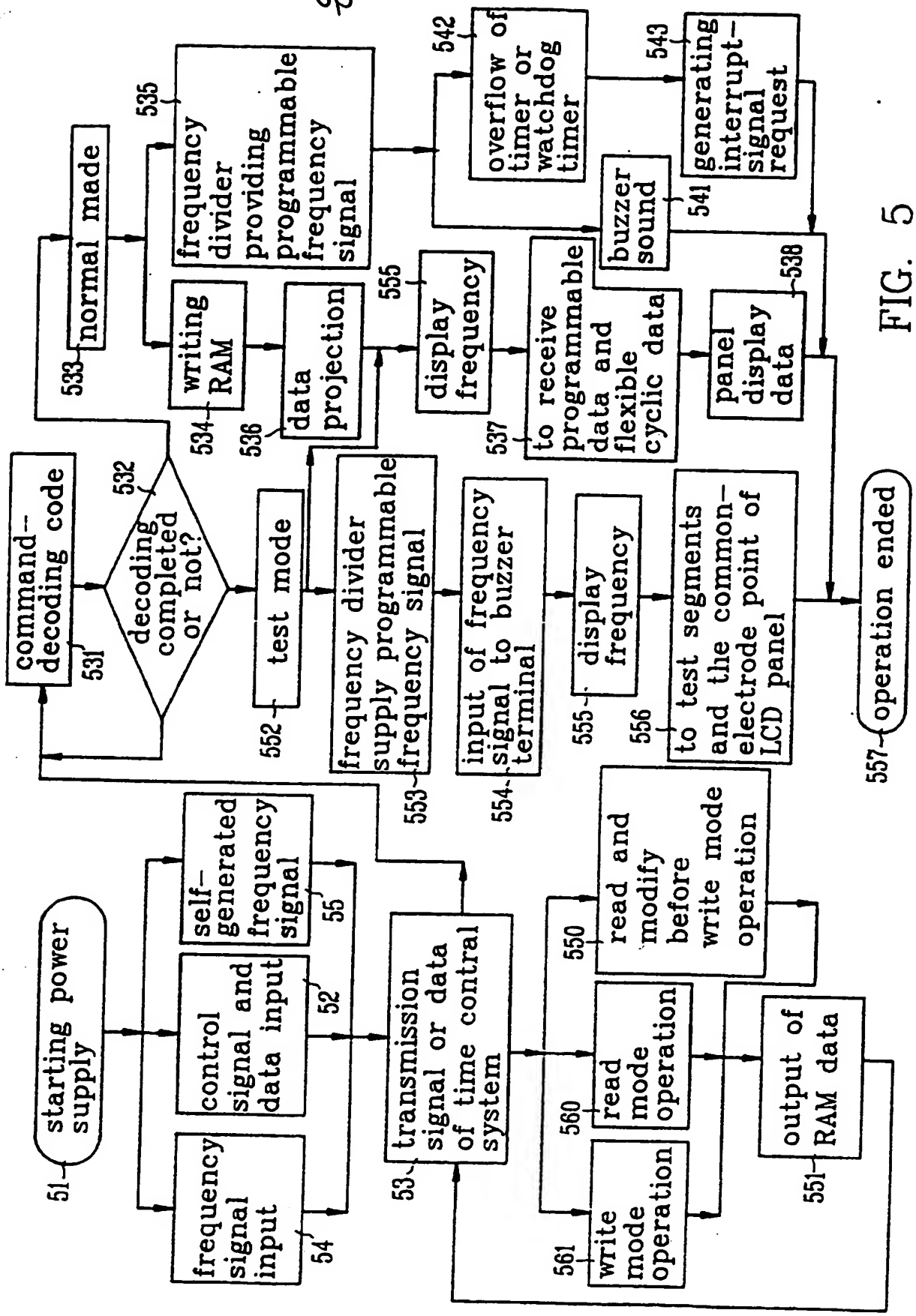
starting power supply
51
control signal and data input
52
frequency signal input
54
self-generated frequency signal
55
transmission signal or data of time contral system
53
command-decoding code
531
decoding completed or not?
532
normal made
533
writing RAM
534
data projection
536
frequency divider providing programmable frequency signal
535
test mode
552
frequency divider supply programmable frequency signal
553
input of frequency signal to buzzer terminal
554
display frequency
555
to receive programmable data and flexible cyclic data
537
display frequency
555
to test segments and the common-electrode point of LCD panel
556
read and modify before write mode operation
550
read mode operation
560
write mode operation
561
output of RAM data
551
overflow of timer or watchdog timer
542
buzzer sound
541
generating interrupt-signal request
543
panel display data
538
operation ended
557

FIG. 5

AN IMPROVED MULTI-FUNCTION SELECTING DEVICE FOR LCD DRIVER

This invention relates to a multi-function selecting device for LCD driver, and particularly to a structure to use command made control and a time control system for providing an improved multi-function selection.

A conventional LCD driver as shown in FIG. 1 is usually to have a plurality of data bits 110, a selected control signal 111 and a timing pulse 112 synchronously put in a shift register 10 of a micro controller; the shift register 10 will have several bits stored therein sent, in a cascade made, into the driver; the microcontroller will send a loading control signal 113 to have the several bit data latched 11, and then send such data into a level shifter 12; after input of a display frequency signal 114, the level shifter 12 will be controlled to have the level-driving circuit 13 applied with a fixed bias 116 and an enabling signal 115 sent the data to a LCD panel 14 to display the data.

FIG. 2 is an operation flow chart, showing the operation of the conventional driving for LCD driver; first the shift register is started; then, several bit data 22 is put in through an interface (a) of microcontroller and driver, and the several bit data is latched 23 by means of a loading control signal; the data and a display frequency are controlled in the level shifter 24, and then an outer bias and an enabling signal are applied thereto so as to have the data sent to a panel 25 to display such data 26 until the latch data being displayed completely.

The aforesaid conventional LCD driver has drawbacks as follows;

1. A latch data containing several bits of data can be put in the shift register under a microcontroller in a cascade made; however, in case of one bit thereof having an error, the whole latch data has to be transmitted into

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the shift register again; such processing mode is deemed cumbersome considerably.

2. When the driver reads data, a latch data containing several bits has to moved out of the shift register in a sequence and then transmitted into the driver; such one-way input into the driver can not be moved in bi-directional transmission, i.e., to have the data read back into the register to make necessary correction.

3. When LCD panel receives data which have an error, such error can not be corrected separately unless re-processing the whole latch data.

4. Since the data terminal of the device is furnished with an input structure, the function of the microcontroller is rather simple, and unable to provide efficient multi-control function.

Summing up the aforesaid description, it is apparent that the conventional LCD driver is unable to meet the current requirements, and should be improved.

Consequently, the inventor has made a careful study theoretically on the aforesaid drawbacks, and provided a concept and design so as to improve the aforesaid drawbacks.

The prime object of the present invention is to provide an improved multi-function selecting device, in which a time-control system is used and operated under a command mode so as to select effective steps, such as testing, buzzer or interruption, etc.

Another object of the present invention is to provide an improved multi-function selecting device, in which the RAM can project a data to a driving circuit under a command mode operation, and then such circuit transmits such data on a panel for display; furthermore, the time-control system and the RAM can perform reading mode, writing mode and reading and modification before re-writing-in mode by means of bi-directional

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switching method.

Still another object of the present invention is to provide an improved multi-function selecting device for LCD driver, in which the oscillator will stop to operate upon the system being discontinued to run, i.e., entering a sleeping state so as to save electric power.

The invention, as well as its many advantages, may be further understood by the following detailed description and drawings in which:

FIG. 1 is a block diagram of the present invention, showing a conventional driving device for LCD (liquid-crystal display) driver.

FIG. 2 is an operation flow chart of the present invention, showing the conventional driving device for LCD driver.

FIG. 3 is a block diagram of the present invention, showing an improved multi-function selecting device for LCD driver.

FIG. 4 is a block diagram of time-control system according to an embodiment of the present invention.

FIG. 5 is an operation flow chart of the improved multi-function selecting device for LCD driver according to an embodiment of the present invention.

In order to let examiner well understand the features and effectiveness of the present invention, it is further described in detail with accompanying drawings as follows:

Referring to FIG. 3, an embodiment of the present invention is shown with a block diagram, which is substantially a brief block diagram of an improved multi-function selecting device for LCD driver; the input terminal of the time-control system 3 is connected with a bit-reading terminal, a bit-writing terminal, a bit-selecting terminal, a data-transmitting terminal and a

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pair of transmission terminals for oscillation system, which form into an input system 1 as shown with a dated line. The time-control system receives the reading bits, the writing bits, the selecting bits, the frequency signal, and data; the time-control system 31 is connected with many output routes, in which the command code signal and the decoding signal are sent to an instruction decoder 32 synchronously. The command code data obtained are in normal mode and test mod; the normal mode data is written into the RAM 33 so as to have the RAM 33 provide a bi-directional data projection operation for the LCD driver 34; simultaneously, the time-control system 31 which will provide a bi-directional switching operation for the RAM 33 in data-reading mode, data-writing mode, and the reading-and-modification before re-writing-in mode. Further, time-control system 31, under test mode, will send out a display frequency signal to LCD driver 34, which with be able, by means of a programmable bias and a programmed flexible cycle, to operate with different LCD chips and to modify a single data a point on the panel, and then such data will be sent to the LCD panel 25 to show the sequent data and the common-electrode data. Another set of output system 2 in the time-control system as shown with a dotted line will, under normal mode control, be supplied with a programmable frequency signal from the frequency divider to the timer or a watchdog timer to enable the same to generate an interrupt request signal upon overflow taking place.

The structure of the time-control system is shown in FIG. 4 as an embodiment thereof, in which an outer oscillator or a quartz oscillator 412 is put in, via an input terminal 3, a loading frequency signal. or an oscillation frequency signal generated with a built-in oscillator 411 of the time-control system; a multiplex switching device is used for selecting one of the aforesaid frequency signal and transmitting the same into a built-in frequency divider 414. Under normal mode control, a programmable frequency 417 will be sent into an enabling unit 415 of the buzzer system; by means of an outer power supply V_{DD}, the buzzer output terminal 416 can

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generate a buzzer sound; or the programmable frequency 417 may be sent into an enabling unit 418 of an interrupt request system; before being sent into a timer 419, the previous data or signal therein must be removed and cleared before loading a frequency signal or being sent into a watchdog timer 420; in that case, the data and signal previously stored in the watchdog timer must be cleared before loading a frequency signal; by means of overflow action thereof, the multiplex-switching device 421 can select frequency signal to send into the enabling device 423; then, two inputs from a watchdog timer and an enabling device are sent synchronously into the OR gate 422, which will generate and send out an enabling and triggering signal so as to cause an interrupt-request signal output 424 to generate an interrupt-request signal. The built-in frequency divider 414 will also, under test mode, send out a low level signal to AND gate 425, while the buzzer input terminal 426 has no any frequency signal to inject in; then, AND gate 425 has no output of display frequency signal; at that time, a programmable frequency signal will be sent to the buzzer system or the interrupt-request system. When the frequency divider 414 sends a high level signal to the AND gate 425, and a frequency signal is injected into the buzzer input terminal 426, the AND gate 425 will have an output of display frequency to the LCD circuit.

Referring to FIG. 5, it is an operation flow chart of an embodiment according to the present invention, in which the power supply 51 is first started; a microcontroller will send into block of control signal and data 52; an injection frequency signal 54 or a built-in frequency signal 55 will be sent into the time-control system so as to enable the same to transmit a signal or data 53; through an instruction decoder 53, the data can be shown whether the decoding step is completed or not 532; if the answer is no, repeat the decoding step; simultaneously, the time control system will also perform writing mode operation 560, read mode operation, and reading and modification before re-writing mode operation; then, the RAM data 551 will be sent through the time control system 53 and to the test mode or

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normal moder for further process so as to select the test mode 552, under which the frequency divider will stop to supply programmable frequency signal 553; then, a frequency signal 554 will be injected into the buzzer terminal so as to obtain an output of display frequency 555 and to enable a test to the segments of the LCD panel and the common-electrode points 556, and continue to operate so until the operation being ended. When the normal mode 533 is selected, the decoded data will be written into RAM 534, and then the data projection 536 will be projected into the driving circuit, which also receives a display frequency 555 from the time controller, a programmable bias and flexible cyclic data 537 so as to enable the panel to show the data modified 538 and other data until the operation being ended. Under normal mode operation, a programmable frequency signal 535 may be generated with the frequency divider so as to select the buzzer system to generate a buzzer sound 541, or to operate as a timer or a watchdog timer overflow 542, and to generate an interrupt-request signal 543 until the operation being ended 557. If the system discontinue to operate, the built-in oscillator or the outer oscillator will stop to operate, being in sleeping state so as to save power.

Summing up the aforesaid description, it is apparent that the present invention is deemed to be useful in the industry of the kind, and to be novel without showing in any pnhlicrtions, and therefore it is conformed with the provisions of Article 19 of the Patent Law.

The aforesaid description is merely to explain the embodiment of the present invention, and any modification thereof is deemed within the spirit and scope of the claims defined.

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Claims

1. An improved multi-function selecting device for LCD driver comprising a time-control system and a LCD driving circuit, which further including:

an instruction decoder for receiving a decoding signal, a command code to be decoded into a normal mode and a test mode;

a RAM for receiving a decoding data sent from said instruction decoder;

a LCD driver for receiving a display frequency from said time-control system and data projected from said RAM so as to provide an output of LCD panel data.

2. An improved multi-function selecting device for LCD driver as claimed in claim 1, wherein said time-control system including:

a built-in oscillator which can generate an oscillation frequency signal;

an outer oscillator which provides an oscillation frequency signal from outside;

a multiplex-switching device connected with said built-in oscillator and said outer oscillator for selecting a signal optionally;

a frequency divider connected electrically with said multiplex-switching device so as to provide a programmable frequency;

a buzzer provided with a programmable frequency signal by means of said frequency divider so as to generate a buzzer sound;

an interrupt-request system provided with a programmable frequency signal by means of said frequency divider; by means of overflow of a timer

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or watchdog timer, an interrupt-request signal being generated;

an input signal system for receiving signal and data upon reading bits, writing bits and selecting bits.

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